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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A61K 9/14, 33/00	A1	(11) International Publication Number: WO 94/28877 (43) International Publication Date: 22 December 1994 (22.12.94)

(21) International Application Number: PCT/US94/06480

(22) International Filing Date: 9 June 1994 (09.06.94)

(30) Priority Data:

076,349	11 June 1993 (11.06.93)	US
113,795	27 August 1993 (27.08.93)	US

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(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KG, KP, KR, KZ, LK, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: BODY CARE COMPOSITIONS CONTAINING CHARGED COLLOIDAL SILICA

(57) Abstract

The effectiveness and/or hydrating ability of body care compositions, such as moisturizers, skin creams, body lotions, shampoo, hair conditioner, styling gel, styling mist, hair dye, hair perming compositions, bath additives, pedicure and manicure products, facial cleanser, facial mist, suntan lotions, and sunscreen lotions, are enhanced by the addition thereto of an aqueous suspension containing small concentrations of charged colloidal silica particles, preferably of a size between about 10 angstroms and 100 angstroms. With skin care products, the hydrating components are better absorbed into the body epidermal structure. In coloring hair, dye components are absorbed into the hair, and in perming hair, the disulfide bonds in the hair can be broken by tension caused by swelling due to water absorption in the hair, both without the use of damaging alkaline solutions.

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"BODY CARE COMPOSITIONS CONTAINING CHARGED COLLOIDAL SILICA"

SPECIFICATION

Background of the Invention

Field: The present invention relates to body care compositions of matter such as moisturizers, lotions, creams, shampoos, hair conditioning, coloring, body building, and perming agents, and to body care methods utilizing such compositions.

State of the Art: Many body care products such as skin and hair care products on the market today make claims to rejuvenate skin and hair. Skin care products are claimed to contain moisturizers for dehydrated aging skin. Hair care products are claimed to build body into limp hair. Apparently none of these preparations address the central issue, which is the ongoing damage to the skin and hair from chronic dehydration.

Most skin care products have an oil or cream base. The problem to be overcome is not one of loss of skin oil but, rather, the chronic loss of moisture, which is one of the aging factors. There is a need for a product which will enable water to penetrate the dehydrated epidermal structures, i.e., skin, hair, and nails.

In many countries, a large percentage of the population utilizes some method of hair coloring and uses some products for permanents, waves or straightening of the hair. In using traditional techniques, each time the hair is treated, its structure is altered and usually altered in a fashion that is detrimental to the hair shaft.

Traditional technology in dealing with hair coloring, conditioning and perming introduces destructive change into the various components of the hair, i.e., the cuticle, the cortex, and the medulla. The cuticle is composed of a layer of flattened, horny scales made up of keratinized protein. These

scales overlap and move over one another to provide a flexible protection, like an armor covering of the hair shaft. Current technology requires use of an alkaline substance which hydrolyzes the scales, which causes them to swell and raise from the hair shaft. Normal procedure then utilizes an acid rinse to stop the alkaline hydrolysis process. The cortex portion of the hair shaft is made up of intertwined molecules of keratin protein. Processing of the hair in alkaline solutions induces softening of keratin through hydrolysis and reduction of strong disulfide bonds. The central portion of the hair fiber is known as the medulla and is composed of soft keratin. The cortex is probably the most important portion of the hair structure as it relates to coloring or perming of the hair.

At the current time, all processing of the hair for coloring or permanents is a result of an alkaline hydrolysis. Alkaline solutions disrupt the cuticular layer and allow penetration of water which causes swelling of the hair. The enlarged pores in the cuticle will allow dye components in aqueous solution to penetrate the hair cuticle. These dye particles can then be trapped inside the cortex of the hair by oxidation and condensation. This imparts a permanent color to the hair.

Current technology for permanent hair coloring is based upon oxidation procedure requiring the use of a peroxide. Initial application of an alkaline solution to the hair causes the disulfide bonds of the protein matrix to be altered or broken. The molecules of the dye components are of sufficiently small molecular size to penetrate the hair cuticle when it is opened by use of an alkaline solution. This allows water and the small dye components to be carried into the hair shaft itself. A peroxide solution is then applied to the hair and penetrates into the hair shaft to oxidize these dye components and cause them to become enlarged and produce color. The enlargement of the dye components upon oxidation traps them in the hair. This is then followed by an acid rinse or

conditioning to counteract the action of the alkaline solution and stop its further damaging action to the hair. Even with the acid rinse, however, the alkaline environment is very damaging to the hair shaft. The hair and the hair proteins are resistant to weak acids. It would be far more desirable to carry out the hair coloring in an acid solution or a neutral pH solution. However, currently known procedures do not allow the use of an acid solution for relatively permanent hair coloring since it will not allow the penetration into the hair shaft or the break down of disulfide bonds. Acid hair coloring compositions are currently available, but the coloring is surface based and usually lasts for only a matter of weeks.

Perming is a two step process. Step one uses an alkaline solution to break the disulfide bonds in the hair cuticle and step two rejoins them in a new position. Different perm formulas break disulfide bonds in different ways. In cold waves, the reforming lotion does the work. In heat activated perms, heat and tension are required in addition to the reforming lotion. In both cases, the reduction process softens the protein and allows it to assume the shape of the curler. The final step in every perm is to saturate the hair with a chemical oxidizing agent, called a neutralizer. Again, the alkaline used to break the disulfide bonds can do significant damage to the hair.

Summary of the Invention

I have discovered that an aqueous composition containing small quantities of an inorganic colloidal silica (preferably specially processed to provide a stable, active configuration) greatly enhances the penetration of water, oils, and collagen into the epidermis of aging dehydrated skin. It also enhances the penetration of water, oils, and collagen into hair shafts. With enhanced penetration into the hair, hair coloring material penetrates the hair shafts to provide brighter color and longer retention of the color in the hair, and water or perming

compositions penetrate into the hair shafts, all without use of alkaline chemicals which can damage the hair, and which are required in the prior art. The colloidal silica composition can be neutral or weakly acidic so as not to cause damage to the hair.

The inorganic colloidal silica can be beneficially used in a wide variety of body care compositions such as in shampoos, conditioners, styling gels, styling mists, hair coloring preparations, hair perming compositions, body lotions, face creams, skin creams, bath additives, pedicure and manicure applications, hand lotions, lip balms, lipsticks, suntan lotions, and sunscreen lotions. The use of the inorganic colloidal silica in facial cleansers, moisturizing creams, and facial mists provide a package for improvement of skin moisture, tone, and youthful appearance. When used in hair perming compositions, the composition will allow water to penetrate into the hair shafts causing them to swell and breaking the disulfide bonds. Upon drying, the bonds will be reformed to provide curls or straightening depending upon the configuration of the hair during drying and reestablishment of the bonds.

The active component of the invention comprises an aqueous suspension of a colloidal silicon dioxide, preferably an aqueous solution with silica suspended therein. The silicon dioxide particles are preferably from about 10 to about 100 angstroms in size and have an electrical charge thereon. The solution is preferably mixed in such a way that the colloidal particles become electrically charged, preferably by circulation of the solution through a magnetic field, and further, that the solution pass through a magnetic void during mixing so that the charged particles assume a stable configuration in relation to internal bonding. The charge on the colloidal particles is stabilized to remain during a relatively long shelf life of the final product by the mixing process and by the addition of molar amounts of citrate or citrate salts. The colloidal particles

are also believed to carry several layers of water bound to the particle.

In one aspect of the invention, the invention comprises a hydration-enhancing composition of matter containing a unique blend of an inorganic colloidal silica in combination with a usual body care composition or hair coloring agent. The final body care or hair coloring compositions of the invention preferably contain colloidal silica in a concentration from about 1 part per million [ppm] to about 50 parts per million [ppm]. However, greater concentrations of colloidal silica are also equally effective, and lesser concentrations may be effective in many applications.

In another aspect of the invention, an aqueous suspension of colloidal silica is used in perming the hair. The hair is rolled tightly on rollers or other forms and the solution of the invention is applied thereto. This causes the hair to swell and break the disulfide bonds therein. These bonds are reestablished upon drying of the hair on the rollers or other forms so the hair takes the new form as with prior art chemical perms.

The aqueous colloidal silica solution of the invention is a potent conductor of charge. When applied to the hair it varies the normal electrostatic fields on the hair shafts and allows current flow on the hair cortex and the hair surface. It is believed that this manipulation of the normal electrostatic field of the hair and the current flow helps in the effectiveness of the hair perming and hair coloring processes.

The invention also includes the method of applying an aqueous solution of colloidal silica as part of a body care, hair coloring, or hair perming procedure.

Brief Description of the Drawings

The best mode presently contemplated for carrying out the invention in actual practice is illustrated in the accompanying drawings, in which:

Fig. 1 is a representation of the structure of the human epidermis or skin;

Fig. 2, a schematic representation of the believed polymerization behavior of silica;

Fig. 3 is a perspective view of a mixing apparatus useful for making colloidal silica solutions according to the invention; and

Fig. 4, a vertical section taken on the line 2-2 through the center of the mixing apparatus of Fig. 1, but with some parts shown in elevation.

Detailed Description of the Illustrated Embodiment

Enhanced body care compositions or products can be formulated by adding an aqueous suspension of colloidal silica to an existing body care product such as a skin cream, body lotion, shampoo, hair conditioner, cleanser, hair coloring solution, hair permanent solution, etc. to bring the concentration of colloidal silica within the body care product to a preferred range of from about 1 ppm to about 50 ppm. The body care product is then used in a normal manner, but it has been found that such product is more effective than the product without the colloidal silica added thereto. The presence of the colloidal silica in the product appears to dramatically increase the ability of the product to penetrate into body parts. Thus, the product and the water, oils, and collagen therein, if present, will actually penetrate into the epidermis, into the hair, or into the nails of a user so that the product can replace components lost from those body parts and moisturize such body parts. The result with skin care products is substantially more hydration or moisturization of the skin to keep its natural tone and consistency and reduce wrinkling, with hair care products to decrease drying and maintain body and manageability, with hair coloring products to provide deeper and more lasting color since the color components better penetrate the hair itself, with both hair coloring and hair perming

products to allow effective coloring or perming of the hair without damaging the hair through use of alkaline solutions, and with the nails, better moisturization to provide better flexibility and strength. When using skin care products of the invention it is believed that the presence of colloidal silica allows the oil and collagen in the product to penetrate the superficial layers of the epidermis rather than merely sit on the surface of the epidermis, and allows the water in the product to penetrate more deeply into the deeper layers of the epidermis.

Fig. 1 is a representation of the structure of the skin. The stratum corneum and stratum lucidum form the outer or superficial layers of the skin. It is believed that the presence of the colloidal silica particles of the invention in an oil or collagen containing composition aid in allowing the oils and collagen to penetrate the superficial layers of the skin. Thus, the oils and collagen will better penetrate the stratum corneum and stratum lucidum. The oils and/or collagen in the superficial layers of the skin will tend to hold moisture in the skin and retard the drying of the skin. It is further believed that the presence of the colloidal silica particles of the invention in a water-containing composition aid in allowing the water to penetrate deeply into the skin, probably all the way to the stratum basale and basement membrane. Such penetration of water into the skin moisturizes or hydrates the skin to combat skin drying by replacing water otherwise lost from the skin.

The aqueous suspension of colloidal silica preferably takes the form of a solution to be added in small amounts to body care compositions or used as part of the hair coloring or perming process and is preferably prepared in such a way that the colloidal particles become charged (it is believed that the particles take on a net negative charge) and assume an active configuration and the charge and configuration is stabilized so that the particles remain charged and remain in suspension

during a relatively long shelf life of the solution and a relatively long shelf life of any products made using the solution. The particles and solution may be stabilized by adding citric acid (tripotassium salt) to the solution containing the particles and pH adjusted with acetic acid so it will also contain traces of citrate and acetate. In a preferred form of the invention, the solution contains about 500 PPM colloidal silica, 0.001 moles/liter of potassium citrate, and traces of acetate, in purified distilled water. This aqueous solution may be added in very small amounts to body care compositions to aid penetration of moisture or oils into epidermal structures such as skin, hair, and nails, or diluted and used as a solution itself in perming procedures.

To prepare the inventive composition, as an example, an aqueous solution of colloidal silicon dioxide is first made up. This can be done by starting with a solution that is about 27% silicon dioxide in 3-4 molar NaOH. As one option, it has been found that citric acid or citric acid salts added in molar amounts about equal to the molarity of the NaOH improve the stability of the end solution. The starting solution and citric acid or citric acid salts, if present, is diluted very slowly, with stirring. Preferably, this is done over a period of several hours. Next, the solution is very slowly titrated with about 0.5-1.0 molar of an acid, usually hydrochloric or acetic acid, to a pH of between about 7.6 and 8.2. Again, this is preferably done over a period of several hours with constant stirring. The final concentration is a solution of preferably about 0.050% (about 500 parts per million) colloidal silica. At this time the silica is present as colloidal particles of between about 10 to 100 angstroms in size.

The nature of the silicate solution is represented by the following equations at 25°C:

(1) $SiO_2 + 2H_2O \rightleftharpoons Si(OH)_4$

(2) $Si(OH)_4 + OH^- \rightleftharpoons HSiO_3^- + 2H_2O$

(3) $2HSiO_3^- \rightleftharpoons Si_2O_3 + 2H_2O$

(4) $HSiO_3^- + OH^- \rightleftharpoons SiO_3 + H_2O$

Fig. 2 is a diagram from The Chemistry of Silica: Solubility, Polymerization, Colloid and Surface Properties, and Biochemistry, by Ralph K. Iler, published 1979 by Wiley, representing schematically the believed polymerization behavior of silica. Under normal circumstances, in a basic solution, shown by arrow B, silica particles in sol grow in size with decrease in numbers. In an acid solution or in the presence of flocculating salts, shown by arrow A, silica particles aggregate into three-dimensional networks and form gels. Neither the enlarged sols nor the silica gels are satisfactory for the invention. Thus, the growth of the sols or the formation of a gel has to be inhibited. In the preferred process for making the silica solution of the invention, as the pH is lowered, polymerization of monomer occurs to form particles, i.e., $Si(OH)_4$ condenses to form colloidal particles. The condensation forms Si-O-Si links. This is believed to lead to a highly porous, tangled network of branching chains as shown by reference numbers 8 and 9 in Fig. 2. These structures appear to accept electrical charge. These particles grow with the lowering of the pH as indicated by arrow A. The solution is inhibited from becoming a gel by the addition of citrate and by generating like charges on the particles which cause the particles to repel one another. Thus, the growth of the particles is stopped after the particles have grown to a size of between about 10 angstroms and 100 angstroms and with structures as shown at 8 and 9.

In order to generate a charge on the silica particles, it is preferred that during the mixing of the colloidal silica solution the solution be circulated through a magnetic field so that movement of the silica particles through the magnetic field generates the electrical charge on the silica particles. Silicon dioxide is a semi-conductor material. If the silica particles are passed through a magnetic field so as to cut through the lines of flux of the field, an electrical charge is generated on the particles as they cut through the lines of

flux. The particles act as both a conductor and a capacitor, i.e., they generate a charge and store the charge. After passing through a magnetic field to generate a charge on the silica particles, it is preferred that the particles be passed through a space substantially void of any magnetic fields. This space allows each of the charged particles to then assume a configuration based on the charges on the particle and the internal bonding of the particle without regard to external fields. It is believed that this provides formation of a very stable colloidal particle. Circulation through the magnetic field and the magnetic void preferably takes place on a repetitive basis during generation of the colloidal solution. It has been found that with circulation through a magnetic field, the silica particles take on a net negative electrical charge.

Apparatus which has been found advantageous for mixing the colloidal solution is shown in Figs. 3 and 4. As shown, a mixing chamber 10 is supported above base 11 by supporting legs 12, secured to mixing chamber 10 as by screws 13. A platform 14 is mounted to the tops of legs 12 and extends over mixing chamber 10 to support a motor 15. A shaft 16 extends from motor 15 to support a mixing blade 17, Fig. 4, in mixing chamber 10. The lower portion 10a of mixing chamber 10 is of conical formation. The mixing chamber and the supporting legs are preferably made of a nonferrous material.

Nonferrous tubing 20 extends from the vortex of the lower conical portion 10a of mixing chamber 10 to the top of the conical portion where it is wrapped into a helical coil, indicated generally as 21, around the conical portion 10a of mixing chamber 10. From the bottom of helical coil 21, tubing 20 extends through an opening 22 in platform 23 supported above base 11 and below mixing chamber 10 by legs 24, and to pump 25. From pump 25, tubing 26 extends to a tee fitting 27, and tubing 28 continues from the tee fitting to the top of mixing chamber 10. A valve 29 is positioned in the base of tee 27 and controls

flow into tubing 30 extending from the base of tee 27. Motor 15 and pump 25 are both electrically powered so have electrical wires 31 and 32, respectively, extending therefrom.

Four electromagnets 34, 35, 36, and 37 are securely mounted in platform 23 such as by being received in recesses therein as shown by broken lines in Fig. 4. Magnets 34, 35, 36, and 37 are arranged so that the poles of the magnets are in a single plane and form the vertices of a quadrilateral shape in that plane. Preferably that quadrilateral shape is a square as for the arrangement illustrated. The poles of adjacent magnets are of opposite orientation such as indicated by the "+" and "-" signs in Fig. 3. With this arrangement, the two positive poles, shown as magnets 34 and 36, form one pair of opposite vertices of the quadrilateral shape while the two negative poles, shown as magnets 35 and 37, form the other pair of opposite vertices. Each of the magnetic poles is magnetically attracted by the two oppositely charged, adjacent poles and repelled by the opposite like charged pole. The four magnets exert a sphere of magnetic influence on one another and create a magnetic field which extends above the magnets, i.e., mostly above the plane containing the poles of the magnets, to encompass the helical coil 21. This provides the magnetic field through which the solution flows during mixing. As the colloidial particles flow through the helical coil 21, they cut through the lines of magnetic flux of the magnetic field. This produces the net negative electrical charge on the particles. It has been found that at least a portion of the space 33 immediately between the magnets is an area substantially void of magnetic field. Thus, a magnetic field is created above the magnets and below the magnets (the field below the magnets is contained by platform 23 if the platform is made of magnetic material such as stainless steel), but the area immediately between the magnets is substantially shielded from all magnetic fields, including, it is believed, the earth's magnetic field. Tubing 20 passes through the area of magnetic void between the magnets prior to

passing through opening 22 in platform 23 and is oriented parallel to each of the four electromagnets and is preferably spaced equidistant from each. As the particles circulate through the helical coil 21, a charge is generated on the particles. When the charged particles pass through the area of magnetic void, the outside magnetic forces on the particles are removed and the particles configure themselves based on the charges thereon and the internal particle bonds to achieve a relatively stable configuration. This configuration remains as the particles emerge from the magnetic void, even when the particles pass through a further magnetic field below the magnets. The presence of the citrates appears to further stabilize the particles.

It is preferred that the four electromagnets 34, 35, 36, and 37 be identical, except for their pole orientation, and that they each produce approximately equal magnetic flux. Electromagnets which create about 2000 to 3000 gauss each have been found satisfactory, and in such instances, each magnet should produce equal flux within plus or minus 200 gauss, i.e. the gauss produced by such magnets should all be equal within a range of about 400 gauss. Also, the magnetic flux for each magnet should be centered in each pole. The electromagnets are powered by a D.C. power supply 38 with wires 39 connecting the power supply to the magnets in standard fashion. A wire 40 extends from D.C. power supply 38 to a source of electrical power, such as a source of standard 120 volt AC power, not shown. It may be necessary to cool the electromagnets. Such cooling may be accomplished in normal manner by circulating a cooling fluid, such as cold water, through a cooling jacket, not shown, surrounding the electromagnets or surrounding the heads of the electromagnets. Also, while electromagnets are shown and currently preferred, permanent magnets may be used. In order to obtain the desired high magnetic field for large mixing equipment, exotic permanent magnets such as neodymium magnets would preferably be used.

To prepare the colloidal suspension of the invention using the apparatus shown and described, mixing chamber 10 is filled with purified water. The use of purified water is presently preferred since it is believed that the water penetrates deeply into the epidermis. The water is purified by series filtering through various filter beds depending upon the impurities in the starting water, by then heat distilling the water, aerating it, and then passing it through an ultraviolet light chamber. It has been found that for most public water supplies, the water should be first chlorinated to 3 PPM and aerated, then passed through a $CaMgCO_3$ (crushed marble) filter, a +35-20 mesh clinoptilolite filter, a particulate filter, and a -20+35 mesh activated carbon filter, before aeration and ultraviolet sterilization.

The purified water is circulated by pump 25 from mixing chamber 10, through the helical coil 21 and the magnetic field generated by electromagnets 34, 35, 36 and 37, through the magnetic void between the magnets, and back into mixing chamber 10 on a continuous basis for about 30 minutes. A silica concentrate comprising 27% silicon dioxide in 3 molar NaOH is then added to the circulating purified water. This mixture is circulated through the helix and magnetic field for about four hours. During this four hours of circulation, equal molar concentrations of citric acid in the form of tripotassium salt is slowly added to the solution. After circulation for about four hours with the slow addition of tripotassium salt, the pH of the solution is adjusted to pH 7.68 with acetic acid (1 molar). The adjusted solution is then circulated for an additional two hours. The resulting solution is then diluted with purified water to a final desired concentration for addition to the body care products, usually to a concentration of 50 PPM or greater, preferably to a concentration of about 500 PPM. Circulation through the helix and the magnetic void is continuous during the whole procedure. When finished, the silica solution is removed from the apparatus by opening valve

29 in tee 27 to allow the finished solution to flow through tubing 30 to storage, packaging, or the next stage of mixing.

It is preferred that the helical coil 21 be oriented so that the mixture travels during circulation therethrough in the direction it would normally circulate when draining from a basin, that is, counterclockwise in the northern hemisphere and clockwise in the southern hemisphere.

The following examples show how the aqueous suspension of colloidal silica can be used to enhance otherwise ordinary body care compositions.

Example I

One cc of a colloidal silica solution of the invention with a silica concentration of 500 PPM was added to 100 ccs of Vaseline Intensive Care Lotion®. After the addition of the silica solution, it was noted that the lotion showed increased absorption into the skin, estimated as a ten-fold increase in absorption, and was more effective in moisturizing the skin.

Example II

One cc of a colloidal silica solution of the invention with a silica concentration of 500 PPM was added to 100 cc of Prell® shampoo. Hair washed with the shampoo with the colloidal silica resulted in hair having a fuller and softer feeling and more manageable than hair washed in the shampoo without the colloidal silica. The shampoo itself was more viscous with the silica solution added and produced thicker lather during use.

Example III

A cleansing primer can be used to remove skin oils and/or make-up prior to the application of a hydrating mist. A preferred cleansing primer contains the following body care components listed as percentages by weight:

43.906% water, 50.00% of an aqueous suspension of the invention containing 50 ppm colloidal silica, 5.00% ammonium laureth sulfate and decyl polyglucose, .25% hydrolyzed collagen, .025% tetrasodium EDTA, .444% hydroxyprofyl cellulose, .25% panthanol, .025% fragrance, .10% sodium hydroxymethyl glycinate.

By using the cleansing primer of the invention, the face feels cleaner than when using other face cleaners or soaps and feels cooler and smoother.

Example IV

A hydrating misting agent comprises an aqueous suspension of the invention of colloidal silica in a preferred concentration range of about 50 ppm, optionally, collagen in a concentration of about 43 ppm, and 0.25% sodium hydroxymethyl glycinate. Such a hydrating mist is used by spraying it on the face and neck. A mask of facial tissue or thin collagen fibers may then be applied along with additional hydrating mist to keep it very moist for about twenty minutes. The water from the mist penetrates the skin, i.e., the epidermal cells and interstitial spaces, and the face feels firmer and the tiny surface lines diminish. As compared to other facial masks, use of the misting agent and facial mask of the invention results in a reduction of wrinkles and a face with a more youthful glow and feel.

Example V

A body care composition, in this instance a surface active cream, contains the following body care components (all percentages are by weight): 58.39% water, 12.81% isopropyl myrestate, 8.44% mineral oil, 4.00% glycerine, 3.84% sorbitan stearate, 2.00% cocoa butter, 1.43% beeswax, 1.20% stearic acid, 1.20% cetyl alcohol, 1.12% polysorbate 60, 1.00% aloe vera oil, .99% glyceryl stearate S.E., 1.00% dimethicone, .75% triethanolamine, .30% sodium borate, .25% panthanol, .15% fragrance, .15% propylparaben, .15% methylparaben, .83% of an aqueous suspension of the invention of 500 ppm colloidal silica, and 0.25% sodium hydroxymethyl glycinate. The colloidal silica is present in a final concentration of about 4.15 parts per million [ppm]. Use of the surface active cream of the invention results in a smoother and softer feeling skin that maintains that feeling and look longer than with use of prior art creams and lotions and, importantly, the cream of the invention does

not leave the oily and greasy feeling of the prior art creams and lotions.

With hair coloring products, it has been found that the silica solution of the invention can be mixed with the dye components and that the dye components are then absorbed through the hair cuticle into the hair similarly as if the hair had been first treated with the usual alkaline solution. However, use of the alkaline solution is completely avoided. After absorption of the dye components into the hair, the hair is treated with an oxidizer, usually a peroxide solution, such as a weakly acidic or neutral hydrogen peroxide solution, which causes oxidation of the dye components in the normal manner. Since an alkaline solution has not been used, the acid rinse or conditioning to stop the action of the alkaline solution is not necessary, however a rinse or conditioning will usually be performed after use of the oxidizing solution.

All biological organisms are permanently located in an atmospheric electrostatic field that varies according to atmospheric conditions (between 100-1000 V/M). Through direct frictional contact, the hair can pick up charge and generate its own electric field. The anatomy of the hair is very similar to a lightening rod (sharp tip), it enables the charged shaft of hair to generate a high electric field. The tip of the hair shaft carries a positive charge while the portion of the hair shaft near the scalp carries a negative charge. Due to the high resistance of normal skin and hair, no compensating charge is supplied to the hair through the skin. This means that hair can stay charged for extended periods of time. The colloidal silica solution of the invention provides a hydrophilic, charged, and highly conductive medium, and allows constant current flow in the hair. This postulated current flow in the hair may ultimately explain operation of the invention.

It is believed that the colloidal silica solution provides highly charged conductive material in the form of the charged silica particles which adhere to the hair shaft and carry color

into the shaft. By using the highly charged solution, it neutralizes the charge on the hair shaft by allowing electrostatic discharge. The discharge of the electrostatic charge allows this shell of hydration to be taken into the hair shaft without damaging the hair, most likely by iontophoresis. It will also carry with it the hair color, which, when in the hair, can then be oxidized in the same fashion as current technology provides.

Experimentation to date suggests that it is possible to alter the porosity and stable hydration of hair at neutral or acidic pH by altering the electrostatic charge on the hair. This is done by applying the highly conductive solution of colloidal silica to the hair. The solution is hydrophilic and bonds readily to the hair. This conductive solution, which is natural and non-toxic, allows constant current flow in the hair matrix and structurally alters the hair due to alteration in bonding between the helixes. This causes changes in permeability to small particles and water, possibly by the process of iontophoresis. This allows penetration of water, dye components, or other material into the hair.

In the perming of hair, i.e., causing substantially permanent changes in the structure of the hair, it has been found that if the hair is secured to a form, such as a curler, and is then treated with the aqueous silica solution of the invention, the hair will absorb large amounts of water without chemical damage. The absorption of water causes the hair to swell. In swelling, the disulfide bonds are broken due to tension on the bonds. The hair is then dried which reestablishes the disulfide bonds, but the bonds are rearranged from when they were broken so that the hair substantially permanently takes on the configuration of the form, e.g., the curl of the curler.

In one example of a perming process, hair is tightly wrapped on a roller. It is then treated with a solution of 0.01m acetic acid, collagen and colloidal silica in a

concentration of 50 ppm. The hair is dried with a conventional hair drier to repair the bonding linkage. If desired, stabilizers may also be used along with drying to repair the bonding linkage. The results of perming in this manner appear to be comparable to the currently used chemical perming processes. However, since there is no chemical damage to the hair, repeated permanents can be given without accumulating trauma to the hair.

With use of the colloidal silica solution of the invention various hair coloring and hair perming and curling processes can be used.

As apparent from the above description, the invention provides a method of increasing the absorption of water or water with other materials, such as dye components, into hair by applying an aqueous solution or suspension of charged colloidal silica particles along with the other material to be absorbed into the hair. Where water is to be absorbed, the aqueous suspension of charged colloidal silica particles provides the water. Where material in addition to water is to be absorbed, the material may be included as part of the aqueous suspension, or the aqueous suspension may be added to the material, and then applied to the hair, or the aqueous suspension of silica particles may be applied to the hair either before or after application of the other material so that it mixes on the hair.

Whereas this invention is here described with reference to embodiments thereof presently contemplated as the best mode of carrying out such invention in actual practice, it is to be understood that various changes may be made in adapting the invention to different embodiments without departing from the broader inventive concepts disclosed herein and comprehended by the claims that follow.

CLAIMS

1. A method of increasing the absorption of water into a body part comprising the step of applying to the body part an aqueous suspension of charged colloidal silica particles.

2. A method of increasing the absorption of water into a body part according to Claim 1, and absorption of additional material into the body part, comprising the additional step of mixing the additional material to be absorbed and the aqueous suspension of charged colloidal silica particles so that the additional material is absorbed into the body part with the water.

3. A method of increasing the absorption of water and additional material into a body part according to Claim 2, wherein the body part is hair and the additional material includes hair coloring dye components.

4. A method of increasing the absorption of water and additional material into a body part according to Claim 2, wherein the body part is hair and the additional material is a usual hair care product.

5. A method of increasing the absorption of water and additional material into a body part according to Claim 2, wherein the body part is an epidermal structure and the additional material is a usual skin care composition.

6. A method of increasing the absorption of water into a body part according to Claim 1, wherein the body part is hair and the colloidal suspension is applied to the hair and changes the electrostatic charge on the hair.

7. A method of increasing the absorption of water into a body part according to Claim 1, wherein the body part is hair and wherein the aqueous suspension of charged colloidal silica particle is applied to the hair in a concentration sufficient to cause enough water to be absorbed by the hair to cause the hair to swell and break the disulfide bonds in the hair.

8. A method of coloring hair comprising the steps of applying an aqueous suspension of charged colloidal silica

particles and hair coloring dye components to the hair whereby the dye components are absorbed into the hair; and applying an oxidizing solution to the hair to oxidize the dye components in the hair.

9. A method of coloring hair according to Claim 5, wherein the dye components are mixed with the colloidal silica suspension prior to application to the hair.

10. A method of coloring hair according to Claim 5, wherein the dye components are applied to the hair after application of the colloidal silica suspension so that the dye components mix with the colloidal silica suspension on the hair.

11. A method of perming hair, comprising the steps of placing the hair on a form, applying an aqueous suspension of charged colloidal silica particles to the hair on the form, allowing water from the colloidal suspension of silica to be absorbed by the hair causing the hair to swell and break the disulfide bonds in the hair; and drying the hair to reestablish the disulfide bonds in the hair on the form so as to conform the hair to the form.

12. A method of perming hair according to Claim 11, wherein the form is a roller.

13. A method of perming hair according to Claim 11, additionally including the step of applying a stabilizer to the hair during drying to help reestablish the disulfide bonds.

14. A body care composition, comprising an effective amount of an aqueous suspension of charged colloidal silica particles; and one or more body care components.

15. A body care composition according to Claim 14, wherein the particles of colloidal silica are from about 10 to about 100 angstroms in size.

16. A body care composition according to Claim 14, wherein the colloidal silica is present in concentration of from about 1 part per million to about 500 parts per million.

17. A body care composition according to Claim 14, wherein the one or more body care components are selected from the group of body care components consisting of::

shampoo, conditioner, styling gel, styling mist, body lotion, skin cream, face cream, bath additive, pedicure composition, manicure composition, hand lotion, lip balm, lipstick, suntan lotion, sunscreen lotion.

18. A body care composition according to Claim 14, wherein the aqueous suspension of colloidal silica has been circulated through a magnetic field so that colloidal silica particles in the suspension of colloidal silica cut through the magnetic flux lines to generate electrical charges on the particles.

19. A body care composition according to Claim 18, wherein the aqueous suspension of colloidal silica has been circulated through an area substantially devoid of magnetic fields after having been circulated through the magnetic field, to allow the colloidal silica particles to configure themselves based on charge and internal bonds without influence of external magnetic fields.

20. A body care composition according to Claim 19, wherein the aqueous suspension of colloidal silica contains silica particles of size between about 10 Angstroms and about 100 Angstroms.

21. A body care composition according to Claim 19, wherein the aqueous suspension of colloidal silica has been generated by continuously circulating a solution of silica in about three to about 4 molar NaOH through the magnetic field and magnetic void over a period of time during which time the solution has been diluted with water to a concentration of about 0.050% silica and the solution has been titrated with an acid to a pH of between about 7.6 and 8.2.

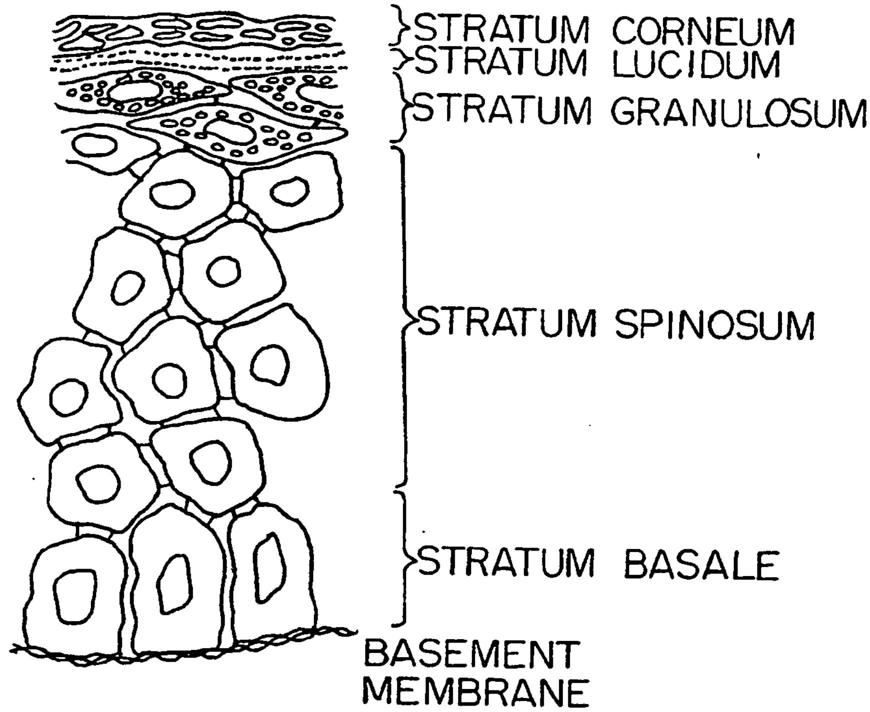
22. A body care composition according to Claim 21, wherein the dilution and the titration were each carried out over a period of time of several hours.

23. A body care composition according to Claim 18, wherein the aqueous suspension has been circulated through the magnetic field in a helical coil.

24. A body care composition according to Claim 14, wherein the effective amount of the aqueous suspension of colloidal silica particles is an amount effective to increase the absorption of at least one of the one or more body care components into a body part.

25. A body care composition according to Claim 24, wherein the body part is an epidermal structure of the body and the body care component absorbed hydrates the epidermal structure.

26. A body care composition according to Claim 24, wherein the body part is hair and the body care component absorbed hydrates the hair.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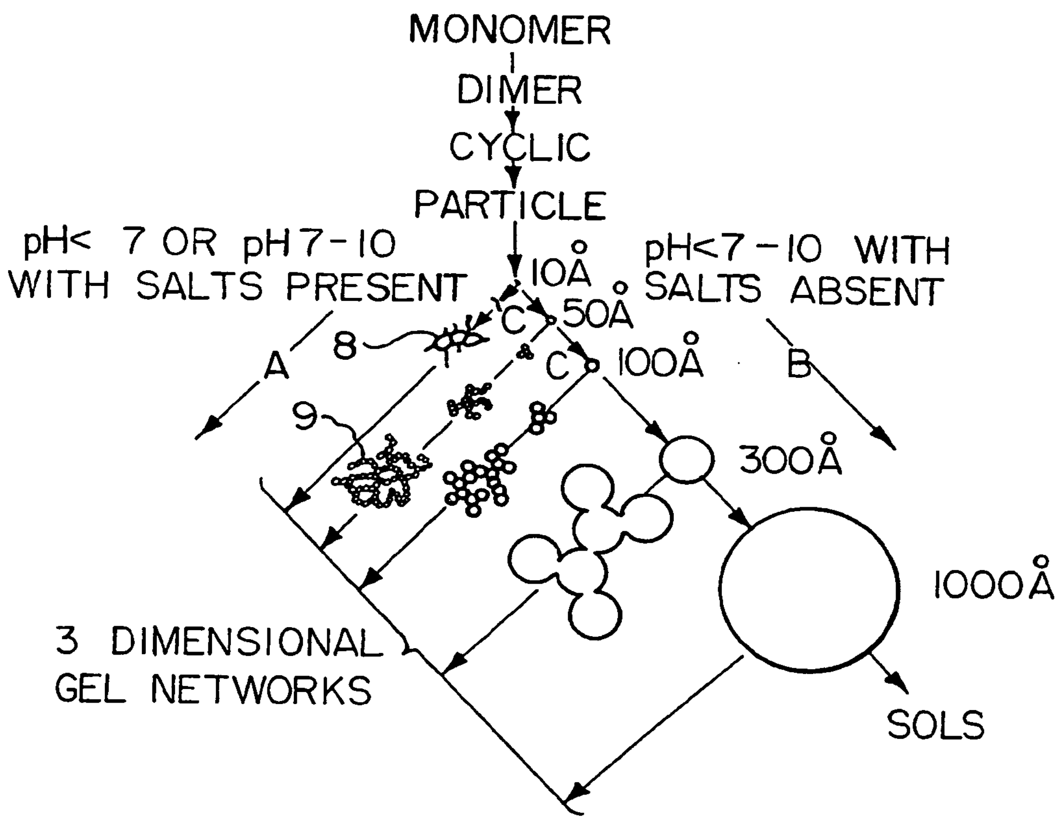
STRATUM LUCIDUM
STRATUM GRANULOSUM
STRATUM SPINOSUM
STRATUM BASALE
BASEMENT MEMBRANE

FIG. 1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pH<7-10 WITH SALTS ABSENT
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3 DIMENSIONAL GEL NETWORKS
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FIG. 2

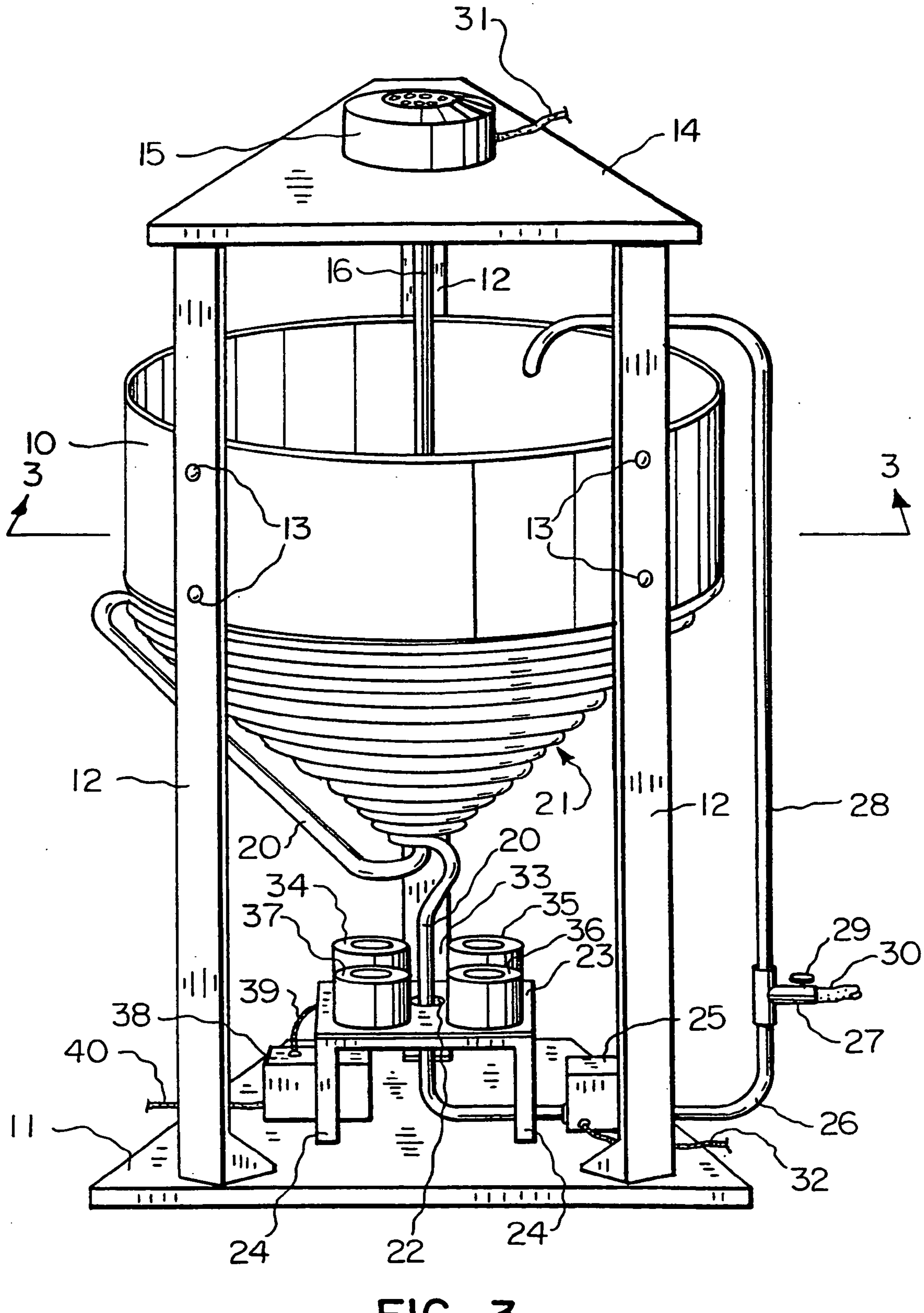
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FIG. 3

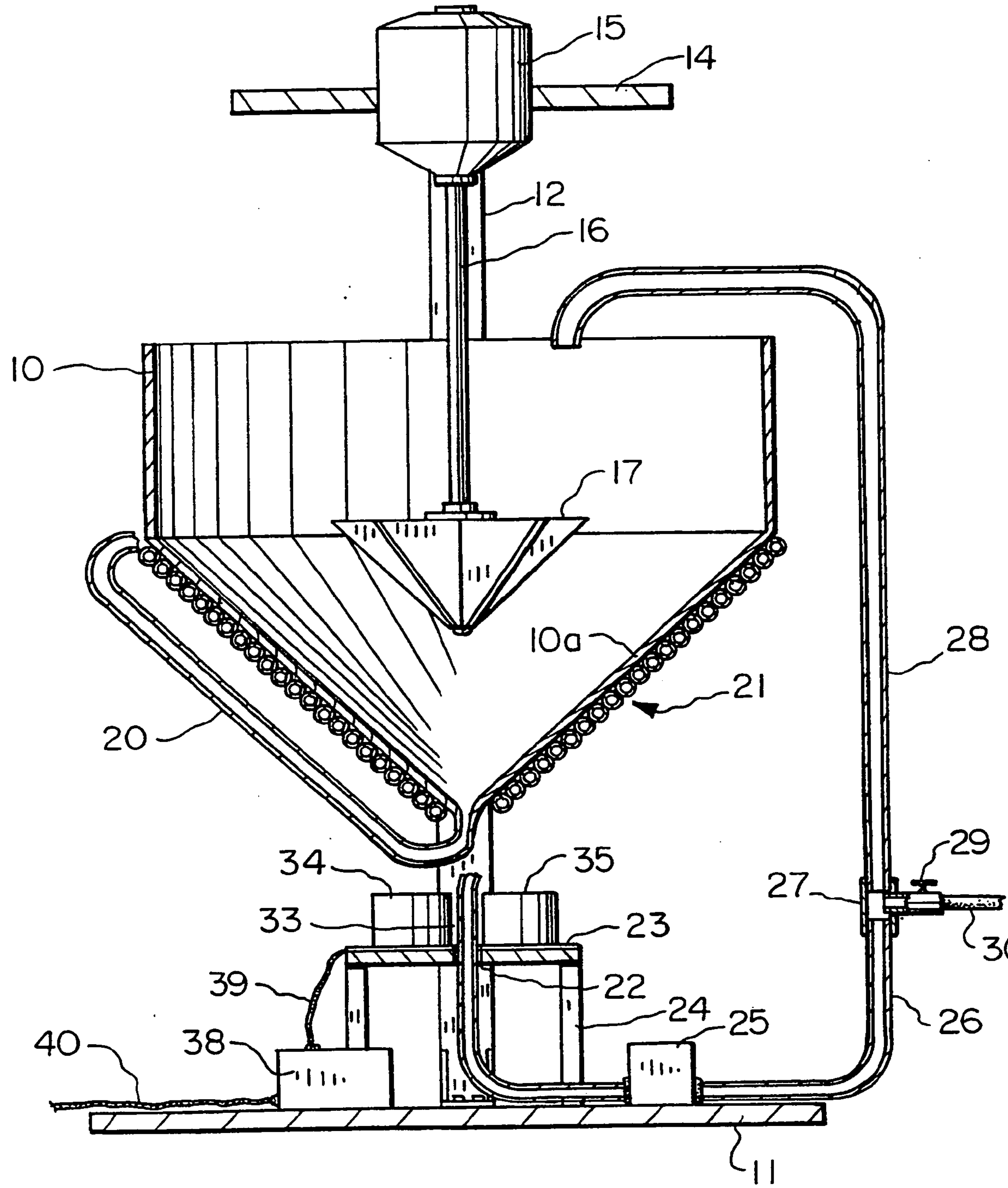
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FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/06480

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A61K 9/14, 33/00
US CL :424/61, 70, 71, 724
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 424/61, 70, 71, 724

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS: Charged silica

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,000,317 (MENDA et al.) 28 December 1976. Note column 2, lines 16-40; column 3, lines 25-36; Example 1.	1, 2, 5, 14, 15, 17, 18, 24, 25
X,P	US, A, 5,286,478 (PERSELLO) 15 February 1994. Note column 29, lines 14-28 and column 42, lines 19-24.	1, 2
A	US, A, 5,002,680 (SCHMIDT et al.) 26 March 1991. Note the abstract and column 8, lines 33-37.	1-26

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

29 AUGUST 1994

Date of mailing of the international search report

23 SEP 1994

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